

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims

We claim:

1. (Original) A method of preparing a liquid, bromine-containing solution, comprising:
 - a. combining a complexing agent, hydrogen peroxide, and anhydrous hydrogen bromide gas; and
 - b. adding an alkaline source.
2. (Original) The method of Claim 1, wherein said complexing agent is sulfamic acid, and further, wherein the mole ratio of said sulfamic acid to said anhydrous hydrogen bromide is between about 0.75:1 and about 1.5:1.
3. (Original) The method of Claim 2, wherein said alkaline source is selected from the group consisting of alkali metal carbonate, earth alkali metal carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide, earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.
4. (Original) The method of Claim 3, wherein said alkaline source is an alkali metal hydroxide, and further, wherein said alkali metal hydroxide is 50% sodium hydroxide solution.
5. (Canceled)

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6. (Original) A method of preparing a liquid, bromine-containing solution, comprising:
- a. combining a source of bromide ions, hydrogen peroxide, and a complexing agent; and
 - b. adding an alkaline source.
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7. (Original) The method of Claim ⁵6, wherein said source of bromide ions is aqueous hydrogen bromide and said complexing agent is sulfamic acid, and further, wherein the mole ratio of said sulfamic acid to said aqueous hydrogen bromide is between about 0.75:1 and about 1.5:1.
- 7
8. (Original) The method of Claim ⁵7, further comprising after step a but before step b, adding a solid halogenating agent and another alkaline source, and then conducting a solid-liquid separation.
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9. (Original) The method of Claim ⁷8, wherein said solid halogenating agent is an organic halogenating agent.
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10. (Original) The method of Claim ⁸9, wherein said organic halogenating agent is selected from the group consisting of trichloroisocyanuric acid, sodium dichloroisocyanurate, sodium dichloroisocyanurate dihydrate, potassium dichloroisocyanurate, dichloroisocyanuric acid, trichloromelamine, N-chloro-*p*-toluenesulfonamide, N-chloromethanesulfonamide, N-chlorosuccinimide, N,N'-1,3-bromochloro-5,5-dimethylhydantoin, N,N'-1,3-bromochloro-5-ethyl-5-methylhydantoin, 1,3-dibromo-5,5-

dimethylhydantoin, 1,3-dichloro-5,5-dimethylhydantoin, and N-bromosuccinimide.

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11. (Original) The method of Claim ⁹10, wherein said organic halogenating agent is trichloroisocyanuric acid.

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12. (Original) The method of Claim ⁷8, wherein said solid halogenating agent is an inorganic halogenating agent.

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13. (Original) The method of Claim ¹¹12, wherein said inorganic halogenating agent is selected from the group consisting of calcium hypochlorite, lithium hypochlorite, and magnesium hypochlorite.

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14. (Original) The method of Claim ¹²13, wherein said inorganic halogenating agent is calcium hypochlorite.

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15. (Original) The method of Claim ⁷8, wherein said alkaline sources are selected from the group consisting of alkali metal carbonate, earth alkali metal carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide, earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.

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16. (Original) The method of Claim ¹⁴15, wherein said alkaline sources are alkali metal hydroxides, and further, wherein said alkali metal hydroxides are 50% sodium hydroxide solution.

17. (Canceled)

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18. (Original) A method of preparing a liquid bromine- and chlorine-containing solution, comprising:

- a. combining a source of bromine ions, hydrogen peroxide and a complexing agent;
- b. adding a first alkaline source and a solid chlorinating agent;
- c. conducting a solid-liquid separation; and
- d. adding a second alkaline source.

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~~19~~. (Original) The method of Claim ¹⁶18, wherein the molar equivalent of the combination of said hydrogen peroxide and said solid chlorinating agent is in excess of the molar equivalent of said bromide ions.

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20. (Original) The method of Claim ¹⁶18, wherein said source of bromide ions is aqueous hydrogen bromide and said complexing agent is sulfamic acid, and further, wherein the mole ratio of said sulfamic acid to total halogen is between about 0.75:1 and about 1.5:1.

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21. (Original) The method of Claim ¹⁶18, wherein said solid chlorinating agent is an organic chlorinating agent.

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22. (Original) The method of Claim ¹⁹21, wherein said organic chlorinating agent is selected from the group consisting of trichloroisocyanuric acid, sodium dichloroisocyanurate, sodium dichloroisocyanurate dihydrate, potassium dichloroisocyanurate, dichloroisocyanuric acid, trichloromelamine, N-chloro-*p*-toluenesulfonamide, N-chloromethanesulfonamide, N-chlorosuccinimide, N,N'-1,3-bromochloro-5,5-dimethylhydantoin, N,N'-1,3-bromochloro-5-ethyl-5-methylhydantoin, and 1,3-dichloro-5,5-dimethylhydantoin.

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23. (Original) The method of Claim ²⁰22, wherein said organic chlorinating agent is trichloroisocyanuric acid.
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24. (Original) The method of Claim ¹⁶18, wherein said solid chlorinating agent is an inorganic chlorinating agent.
- ²³
25. (Original) The method of Claim ²²24, wherein said inorganic chlorinating agent is selected from the group consisting of calcium hypochlorite, lithium hypochlorite, and magnesium hypochlorite.
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26. (Original) The method of Claim ²³25, wherein said inorganic chlorinating agent is calcium hypochlorite.
- ²⁵
27. (Original) The method of Claim ¹⁶18, wherein said first and said second alkaline sources are selected from the group consisting of alkali metal carbonate, earth alkali metal carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide, earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.
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28. (Original) The method of Claim ²⁵27, wherein said first and said second alkaline sources are alkali metal hydroxides, and further, wherein said alkali metal hydroxides are 50% sodium hydroxide solution.
29. (Canceled)
- ²⁷
30. (Original) A method of preparing a liquid, bromine-containing solution, comprising:
- a. combining a source of bromide ions, a complexing agent, and a solid halogenating agent;

- b. conducting a solid-liquid separation; and
- c. adding an alkaline source.

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31. (Original) The method of Claim ²⁷30, wherein said source of bromide ions is sodium bromide solution and said complexing agent is sulfamic acid, and further, wherein the mole ratio of said sulfamic acid to said sodium bromide solution is between about 0.75:1 and about 1.5:1.

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32. (Original) The method of Claim ²⁷30, wherein said solid halogenating agent is an organic halogenating agent, and further comprising before step b, adding another alkaline source.

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33. (Original) The method of Claim ²⁹32, wherein said organic halogenating agent is selected from the group consisting of trichloroisocyanuric acid, sodium dichloroisocyanurate, sodium dichloroisocyanurate dihydrate, potassium dichloroisocyanurate, dichloroisocyanuric acid, trichloromelamine, N-chloro-*p*-toluenesulfonamide, N-chloromethanesulfonamide, N-chlorosuccinimide, N,N'-1,3-bromochloro-5,5-dimethylhydantoin, N,N'-1,3-bromochloro-5-ethyl-5-methylhydantoin, 1,3-dibromo-5,5-dimethylhydantoin, 1,3-dichloro-5,5-dimethylhydantoin, and N-bromosuccinimide.

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34. (Original) The method of Claim ³⁰33, wherein said organic halogenating agent is trichloroisocyanuric acid.

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35. (Original) The method of Claim ²⁹32, wherein said alkaline sources are selected from the group consisting of alkali metal carbonate, earth alkali metal

carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide, earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.

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36. (Original) The method of Claim ³²35, wherein said alkaline sources are alkali metal hydroxides, and further, wherein said alkali metal hydroxides are 50% sodium hydroxide solution.

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37. (Original) The method of Claim ²⁷36, wherein said solid halogenating agent is an inorganic halogenating agent.

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38. (Original) The method of Claim ³¹37, wherein said inorganic halogenating agent is selected from the group consisting of calcium hypochlorite, lithium hypochlorite, and magnesium hypochlorite.

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39. (Original) The method of Claim ³⁵38, wherein said inorganic halogenating agent is calcium hypochlorite.

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40. (Original) The method of Claim ³⁴39, wherein said alkaline source is selected from the group consisting of alkali metal carbonate, earth alkali metal carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide, earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.

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41. (Original) The method of Claim ³⁷40, wherein said alkaline source is an alkali metal hydroxide, and further, wherein said alkali metal hydroxide is 50% sodium hydroxide solution.

42. (Canceled)

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(Original) A method of preparing a liquid bromine- and chlorine-containing solution, comprising:

- a. combining a source of bromide ions, a complexing agent, and a solid chlorinating agent;
- b. conducting a solid-liquid separation; and
- c. adding an alkaline source.

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(Original) The method of Claim ³⁹43, wherein said source of bromine ions is sodium bromide solution and said complexing agent is sulfamic acid, and further, wherein the mole ratio of said sulfamic acid to said sodium bromide solution is between about 0.75:1 and about 1:5.1.

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(Original) The method of Claim ³⁹43, wherein a molar excess of said solid chlorinating agent to said bromide ions is employed.

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(Original) The method of Claim ⁴¹45, wherein said solid chlorinating agent is an organic chlorinating agent, and further comprising before step b, adding another alkaline source.

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(Original) The method of Claim ⁴²46, wherein said organic chlorinating agent is selected from the group consisting of trichloroisocyanuric acid, sodium dichloroisocyanurate, sodium dichloroisocyanurate dihydrate, potassium dichloroisocyanurate, dichloroisocyanuric acid, trichloromelamine, N-chloro-*p*-toluenesulfonamide, N-chloromethanesulfonamide, N-chlorosuccinimide, N,N'-1,3-bromochloro-5,5-dimethylhydantoin, N,N'-

1,3-bromochloro-5-ethyl-5-methylhydantoin, and 1,3-dichloro-5,5-dimethylhydantoin.

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48. (Original) The method of Claim ⁴³47, wherein said organic chlorinating agent is trichlorosiocyanuric acid.

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49. (Original) The method of Claim ⁴²46, wherein said alkaline sources are selected from the group consisting of alkali metal carbonate, earth alkali metal carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide, earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.

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50. (Original) The method of Claim ⁴⁵49, wherein said alkaline sources are alkali metal hydroxides, and further, wherein said alkali metal hydroxides are 50% sodium hydroxide solution.

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51. (Original) The method of Claim ⁴⁴48, wherein said solid chlorinating agent is an inorganic chlorinating agent.

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52. (Original) The method of Claim ⁴⁷51, wherein said inorganic chlorinating agent is selected from the group consisting of calcium hypochlorite, lithium hypochlorite, and magnesium hypochlorite.

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53. (Original) The method of Claim ⁴⁸52, wherein said inorganic chlorinating agent is calcium hypochlorite.

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54. (Original) The method of Claim ⁴⁷51, wherein said alkaline source is selected from the group consisting of alkali metal carbonate, earth alkali metal carbonate, alkali metal bicarbonate, earth alkali metal bicarbonate, alkali metal oxide,

earth alkali metal oxide, alkali metal hydroxide, and earth alkali metal hydroxide.

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55. (Original) The method of Claim ⁵⁰54, wherein said alkaline source is an alkali metal hydroxide, and further, wherein said alkali metal hydroxide is 50% sodium hydroxide solution.

56. (Canceled)

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57. (Original) A method of preparing a bromine-containing solid, comprising:

- a. combining a bromine compound in the oxidation state of -1, hydrogen peroxide, and a complexing agent;
- b. adding an alkaline source; and
- c. promoting crystallization of a bromine-containing solid.

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58. (Original) The method of Claim ⁵²57, further comprising after step a but before step b, adding a solid halogenating agent and another alkaline source, and then conducting a solid-liquid separation.

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59. (Original) The method of Claim ⁵³58, wherein said solid halogenating agent is an organic halogenating agent.

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60. (Original) The method of Claim ⁵³58, wherein said solid halogenating agent is an inorganic halogenating agent.

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61. (Original) The method of Claim ⁵²57, further comprising after step c, recovering said bromine-containing solid.

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62. (Original) The method of Claim ⁵⁶61, wherein said bromine-containing solid is selected from the group consisting of the alkali metal salt of hydrated N-

bromosulfamate and the earth alkali metal salt of hydrated N-bromosulfamate.

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63. (Original) The method of Claim ⁵⁶61, further comprising after recovering said bromine-containing solid, dehydrating said solid.

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64. (Original) The method of Claim ⁵⁸63, wherein said dehydrated bromine-containing solid is selected from the group consisting of the alkali metal salt of anhydrous N-bromosulfamate and the earth alkali metal salt of anhydrous N-bromosulfamate.

⁶⁰
65. (Original) A method of preparing a bromine-containing solid in equilibrium with its saturated solution, comprising:

- a. combining a bromine compound in the oxidation state of -1, hydrogen peroxide, and a complexing agent;
- b. adding an alkaline source;
- c. promoting crystallization of a bromine-containing solid; and
- d. recovering a slurry of said bromine-containing solid in equilibrium with its saturated solution.

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66. (Original) The method of Claim ⁶⁰65, further comprising after step a but before step b, adding a solid halogenating agent and another alkaline source, and then conducting a solid-liquid separation.

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67. (Original) The method of Claim ⁶¹66, wherein said solid halogenating agent is an organic halogenating agent.

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68. (Original) The method of Claim ⁶¹68, wherein said solid halogenating agent is an inorganic halogenating agent.

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69. (Original) The method of Claim ⁶⁰69, wherein said bromine-containing solid is selected from the group consisting of the alkali metal salt of hydrated N-bromosulfamate and the earth alkali metal salt of hydrated N-bromosulfamate.

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70. (Original) A method of preparing a bromine-containing solid, comprising:

- a. combining a source of bromide ions, a complexing agent, a first alkaline source, and a solid, organic halogenating agent;
- b. conducting a solid-liquid separation;
- c. adding a second alkaline source; and
- d. promoting crystallization of a bromine-containing solid.

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71. (Original) The method of Claim ⁶⁵70, further comprising after step d, recovering said bromine-containing solid.

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72. (Original) The method of Claim ⁶⁶71, wherein said bromine-containing solid is selected from the group consisting of the alkali metal salt of hydrated N-bromosulfamate and the earth alkali metal salt of hydrated N-bromosulfamate.

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73. (Original) The method of Claim ⁶⁶71, further comprising after recovering said bromine-containing solid, dehydrating said bromine-containing solid.

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74. (Original) The method of Claim ⁶⁸73, wherein said dehydrated bromine-containing solid is selected from the group consisting of the alkali metal salt of

anhydrous N-bromosulfamate and the earth alkali metal salt of anhydrous N-bromosulfamate.

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75. (Original) A method of preparing a bromine-containing solid in equilibrium with its saturated solution, comprising:
- combining the source of bromide ions, a complexing agent, a first alkaline source, and a solid, organic halogenating agent;
 - conducting a solid-liquid separation;
 - adding a second alkaline source;
 - promoting crystallization of a bromine-containing solid; and
 - recovering a slurry of said bromine-containing solid in equilibrium with its saturated solution.

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76. (Original) The method of Claim 75, wherein said bromine-containing solid is selected from the group consisting of the alkali metal salt of hydrated N-bromosulfamate and the earth alkali metal salt of hydrated N-bromosulfamate.

77. - 92. (Canceled)

93. (Withdrawn) A method for microbiological control in industrial water systems, comprising the addition to the water of the bromine-containing liquid composition of Claim 77.
94. (Withdrawn) A method for microbiological control in industrial water systems, comprising the addition to the water of the mixed halogen liquid composition of Claim 83.

95. (Withdrawn) A method for microbiological control in industrial water systems, comprising the addition to the water of the solid bromine-containing composition of Claim 86.
96. (Withdrawn) A method for microbiological control in residential water systems, comprising the addition to the water of the bromine-containing liquid composition of Claim 77.
97. (Withdrawn) A method for microbiological control in residential water systems, comprising the addition to the water of the mixed halogen liquid composition of Claim 83.
98. (Withdrawn) A method for microbiological control in residential water systems, comprising the addition to the water of the solid bromine-containing composition of Claim 86.
99. - 104. (Canceled)